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PAGE		PAGE	
Breeding Goats and Sheep for Milk Production	221	Technical Personnel for Post-War Development	227
Man's Most Creative Years—Then and Now	222	The Seventh Wright Brothers Lecture	228
Estimation of Crop Yields. By V. G. PANSE AND R. J. KALAMKAR	223	The Indian Scientific Mission	228
A Rapid Method for the Mechanical Analysis of Soils for Extensive Soil Survey Work. By N. D. VYAS AND K. C. BATRA	225	Letters to the Editor	229
		Reviews	240
		Science Notes and News	241

BREEDING GOATS AND SHEEP FOR MILK PRODUCTION

THAT India produces milk much below her requirements is now a well-accepted fact. One of the main contributing factors is insufficiency of fodder to maintain the country's comparatively large cattle population. This has gradually led to the steady degeneration of cattle. This state of affairs is reflected in the acute shortage of milk which is being universally experienced during the present emergency, when, even the small supply of milk available to the general public is of very doubtful quality. The two alternatives for remedying this are either to import large quantities of dried and condensed milk which is bound to further deteriorate the milk problem of the country, or, to devise ways and means for lowering the cost of production. The best way in which the latter can be achieved is to keep smaller animals than the cow and the buffalo, which are more efficient as milk producers. An average village cow may be estimated to consume a minimum of about 30 lbs. of roughages and 2 lbs. of concentrates per day and produce 2½ lbs. of milk. On the other hand a small animal like the goat consuming about one-fourth this quantity of food will give, if not the same quantity of milk, relatively much better yields. Thus there is a distinct possibility of easing the milk problem of the country with the available quantities of fodder. The problem of fodder production is such that apart from the present war conditions, no immediate solution can be expected even in the post-war period. It cannot of course be suggested that goats should entirely replace cows and buffaloes. What is implied is that only the better quality of bigger animals should be maintained, and with the food that is saved probably the maintenance of two or three smaller animals would prove more economical. Further, there are many waste lands where big animals like the cow and the buffalo cannot thrive and this can be profitably employed for rearing goats.

Normally India maintains a good size of goat population, viz., about sixty million goats. Of these, many are of the meat variety but a few breeds like the Surti, the Jumana Pari, the Bar-Bari, the Kamori and the Cutchi, possess good milking potentialities. Most of these animals are not properly maintained and looked after. Although goat-keeping has been practised since the earliest time, breeding according to a definite plan does not seem to have received adequate attention. On an average, country goats yield about a pound of milk per day over a lactation period of about 180 days. With reasonable care this output can at least be increased threefold in a short period. The goat has been commonly termed "the poor man's cow". However, if let free by itself it may well prove a poor man's ruin. Under village conditions goats are left grazing in the open and this is supplemented by leaves of trees and shrubs. Goats love browsing and if left without any supervision they will destroy all vegetation. But this accusation may be directed against almost any animal and it is quite essential that their movements should be controlled.

Though goat is a browser, it can easily be accustomed to stall-feeding. Further, goats will take a wide variety of feeds normally not consumed by other animals, e.g., leaves of trees. A goat is a hardy animal which can be accommodated in a small space and two good milking goats will well serve the needs of an average family. Many of the city dwellers cannot possibly keep a big animal like a cow, but can manage to find place for a goat. Should this suggestion be widely accepted and put into practice, it will go a long way to supply an important part of the nutritional requirements of families with low incomes. In every city or town there are small plots of land on which some fodder can be grown and utilised for keeping goats, thus saving a portion of the wages earned, which would be

otherwise spent on what now happens to constitute one of the most expensive items of diet. Thus goat-keeping can play a vital part in building up the health and vitality of the nation, which have been undermined through years of malnutrition and disease.

Systematic breeding of milk-goats has long been neglected in India. In Central Europe, where milk-goats are very popular, an average yield of 1,800 lbs. of milk per annum is considered as the normal output. Good milch goats with an annual milk yield of 3,000-4,000 lbs. are not uncommon. In India some work on improving the milking qualities of goat has been taken up recently by Government organizations. The number of agencies, the number of animals and the duration of the work are so small that hardly any effects of these enterprises will be felt by the public at large. What is needed is that milk-goat breeding should be taken up as a national and vital necessity by the middle classes all over the country. The results of the few experiments that have been carried out are quite encouraging. Country goats by selective breeding have given about 40 per cent. more milk in the third generation. In a few cases as high as 1,100 lbs. of milk covering a lactation period of 210 days has been recorded. Thus, it is possible to improve the performance of our goats with a little care and attention. The principal and immediate object of any scheme to further goat-keeping and breeding should be to obtain animals with as high a yield as possible rather than standardising their form and colour. In the beginning cross-breeding with imported stock may also prove useful.

In some cases, prejudice exists against the use of goat milk. One of the commonest is attributed to flavour. This is largely due to unhygienic conditions in which milk is produced rather than to any inherent defects. The nature of food given will also play some part. Nutritionally, goat milk is as valuable as, if not more than, that from cow or buffalo. On an average

it is richer in fat than cow's milk. There is also a belief that domesticated goats are very susceptible to diseases. But here again there is no scientific evidence to support this conclusion. Goat milk is well-known to be normally free from tuberculosis germs. Besides, milk-goats have been kept under domesticated conditions in other countries and there is no reason why India should be an exception.

There is yet another animal whose possible potentialities for milk production have not been explored in this country and that is sheep. India has a sheep population of nearly thirty millions. Of these the Lohi, the Kuka, the Kathiawar, the Hashnagri, the Gurez and the Balkhi are known to be good yielders and regularly milked. Ewes of these breeds yield on an average 1-2 lbs. of milk per day and yields as high as 8 lbs. per day have been recorded. From the above breeds the Kuka, and the Lohi are the best and their average daily yield will easily come to 2-3 lbs. If these breeds are systematically developed they will prove as profitable as goats. Sheep milk is also very rich in fat.

For meeting the immediate milk requirements of the country the rearing of goats and sheep should be taken up seriously. The initial cost as well as the maintenance cost of these animals will probably amount to one-fifth of the money spent after bigger animals for whose maintenance it is difficult to find enough food. To make a start in this line the object should be high milk production even though resort has to be taken to cross-breeding. If rearing of these animals is taken up by the poorer classes in urban centres on a co-operative basis, the possible benefits that can be obtained are unlimited. Besides milk, these animals yield wool or hair, mutton, skin and manure. Thus they will repay their cost in a very short time. We have no doubt that this problem will receive the attention of the Imperial Council of Agricultural Research.

MAN'S MOST CREATIVE YEARS—THEN AND NOW

AT what age do eminent men make their most significant contributions? Is this age the same for various periods in the history of thought? Lehman approached these questions by plotting age-of-best-production curves for 15 different fields. His study of physicists is typical. He chose 89 deceased physicists listed in a source book of physics, and found that 45 of them were born before 1785, and the other 44 between 1785 and 1867. He then plotted the number of major contributions made by each group in successive decades of life. To compensate for early deaths, he converted the data to percentages. The early group of physicists made its highest percentage of great contributions between the ages of 40 and 50, and then showed a rapid decline in quality of work. But the more recent group reached its crest between 30 and 40. In fact, the "recent"

curve is almost identical with the "early" curve, except that it is shifted ten years ahead.

Similar results were obtained for geology, mathematics, inventors, botany, pathology, "Description of Diseases", medicine, philosophy, literature, education, economics and political science. In all 12 fields the greatest contributions of the most eminent men seem to come at an earlier age than they did a century ago. This also held true for a group of 250 minor economists and political scientists. But in chemistry and oil painting the age curves for the two periods coincide. Lehman has no certain explanation of his findings, but thinks speedier publication, stimulation and better opportunities favour the more recent men. At least his results show clearly that young contributors have just as good a chance now as they ever did.

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ESTIMATION OF CROP YIELDS

By V. G. PANSE¹ AND R. J. KALAMKAR²

In a previous article in this Journal (May 1944), the authors had briefly reviewed the problem of forecasting and estimating yields of agricultural crops, and had described an experiment carried out in Akola district in Berar to estimate the yield of cotton in that district in the season 1942-43. The experiment illustrates the method of investigating the problem in that its design enables us to secure technical information on the strength of which future surveys may be planned more efficiently.

The results of the experiment in Akola indicated that it was sufficient to harvest only one plot per field; but a larger number of fields per village would lead to an increased accuracy of the yield estimate. The effect of plot size on accuracy was not appreciable and a change in the present plot size of one-tenth acre was, therefore, not considered necessary. Following these conclusions, the experiment was repeated in Akola district in the year 1943-44, with only one plot of one-tenth acre size ($35' \times 132'$) per field but selecting four fields instead of two per village while keeping the number of villages the same as in the previous year, viz., ten in each tahsil. These modifications simplified the plan of sampling and at the same time a more accurate estimate of yield was anticipated without any increase in the amount of work or in the cost of survey. To verify the results relating to the sampling technique, another survey was simultaneously carried out in the adjoining district of Buldana with the same design that was adopted in the Akola experiment in 1942-43, i.e., selecting ten random villages per tahsil, two random cotton fields per village and two random plots of three-tenth acre size per field, each plot subdivided into six longitudinal sections of one-twentieth acre. There are five tahsils and 1364 villages in Buldana district and the fifty villages selected for the survey formed a 3.7 per cent. sample of all villages in the district.

The two districts have a common boundary between them and an important feature of this year's survey was that an independent arrangement was made to find out the total production of cotton in both districts through ginning factory returns. Ginning factory owners are required by law, to submit weekly returns of the amount of cotton ginned throughout the season, but these figures cannot by themselves represent the actual production of cotton in the district as some unginned cotton may be consumed domestically or held over until the next season, while cotton may be brought in from outside and ginned in the district or unginned cotton may be exported from the district. Ginning returns must be corrected for these factors before the figure for the total production of cotton in the district can be arrived at. Careful enquiries into these factors were made by the district land records

and revenue staff under the direction of the Director of the Land Records Department, who had set up a particularly effective organization to register all cotton traffic crossing the borders of these two districts. An alternative estimate of total production may be based on the registration of cotton carts arriving at the cotton markets. All cotton markets in Berar maintain this information; but it is usually incomplete as some cotton carts do not go to the market or are sold at centres where there is a ginning factory but no cotton market. Ginning returns thus form a more reliable basis for calculating total production.

The value of an independent check of this kind for verifying the results of crop cutting experiments made on randomly selected plots is obvious. Though such experiments have sound statistical theory behind them and are designed to give an unbiased estimate of yield with a determinable accuracy, it is desirable to demonstrate their reliability in a manner that administrators and other practical men can appreciate easily and thereby provide convincing evidence of the efficacy of the method. A random sampling survey will then be preferred to alternative procedures involving a complete census of production on account of its greater simplicity, less cost and the availability of the results within a short time after harvest is over, this last being the most important advantage from the commercial view-point.

The two districts in which the survey was carried out in 1943-44 occupy an area of 7,857 sq. miles. Cotton was grown over 11 lacs of acres during the season which represents slightly more than one-third of the area under cotton in the whole Province. The total cost of the scheme was Rs. 18,000 of which roughly two-thirds was spent on the crop cutting experiments and one-third on the registration of the cotton traffic across the borders of the two districts.

The analysis of variance of plot yields in each tahsil pooled over the whole district is shown below for the two districts.

Analysis of variance of plot yields

Due to	Akola district*		Buldana district†	
	Degrees of freedom	Mean sq.	Degrees of freedom	Mean sq.
Villages ..	54	386.2	45	6836
Fields ..	180	212.5	50	4334
Plots	100	407

* 1/10 acre plots; † 3/10 acre plots (Sum of six 1/20 acre sections).

The last item is blank in Akola because there was only one plot per field. Mean squares for Buldana may be made comparable to those

¹ Institute of Plant Industry, Indore.² Department of Agriculture, Central Provinces, Nagpur.

for Akola by dividing by 9. As in the last year, the predominant portion of the total variation in yield is that due to differences between fields in the same village. Last year the village mean square in Akola district was roughly 1·4 times the mean square for fields, as compared to the ratios of 1·8 and 1·6 in Akola and Buldana this year. The mean square due to fields is 10·7 times that for plots in Buldana. This ratio was 7·5 in Akola last year. Thus, while the absolute magnitude of variation from different sources may differ rather widely from season to season and from district to district, its relative magnitude appears to remain approximately of the same order. This latter fact makes it possible to devise an efficient sampling technique suitable for general application over the rainfed cotton tract of peninsular India and to serve as a reasonable basic design in extending the yield survey to the irrigated tracts. Results with different plot sizes in Buldana confirm the conclusion derived from a similar study in Akola last year, viz., that the choice of a particular plot size in preference to another within the range tried is not likely to be of any importance in increasing the accuracy of mean yield. The plot size of one-tenth acre at present in use will, therefore, be adopted in future surveys.

The average yield of kapas (seed-cotton) per acre was estimated at 282 lbs. per acre in Akola and 299 lbs. per acre in Buldana districts. These estimates are subject to standard errors of 4·7 per cent. and 6·7 per cent. respectively. The standard error in Akola was 6·3 per cent. last year, and the modifications made in the plan of sampling have resulted in greater accuracy which was anticipated. The standard of precision in Buldana is approximately the same as was attained in Akola with an identical sampling design last year. The official estimate of yield was 248 lbs. per acre for Akola and 253 lbs. for Buldana. These figures are 10 and 17 per cent. lower than the corresponding experimental estimates. The district revenue and agricultural staff who were asked to inspect the crop of the fields selected for the survey also under-estimated the yield. It will be remembered that last year when the yield was poor (136 lbs. per acre) it was grossly over-estimated by the same agencies. Yields are thus over-estimated when they are poor and under-estimated when they are really good. This is an expected consequence of the tendency not to deviate widely from the "normal" yield—the 'thirteen-anna' complex as it is sometimes described.

The inquiry made by the Director of Land Records into the total production of kapas in these two districts gave the following results.

In converting the figures for lint supplied by the ginning factories into those of kapas, a conventional ginning percentage of 33·3 is usually adopted. This causes considerable error due to seasonal and varietal variation in ginning percentage. The improved variety, Jarila, which had spread to 67 per cent. of the cotton area in Akola and 89 per cent. area in Buldana was found to have a ginning percentage of 37·5 in this particular season. This

fact was taken into account in arriving at the figure for kapas ginned. It may be noted incidentally that according to the information

	Akola district	Buldana district
Kapas ginned ..	kandies*	kandies
204520 ..	236704	44901
Net import of unginned kapas
Net export of unginned kapas ..	20015	..
Carry over to next season ..	1823	2203
Total production of kapas in the district ..	22638	104036
	acres	acres
Area under cotton at final forecast ..	588183	513376
Yield of kapas per acre ..	301·7 lbs.	296·3 lbs.

* 1 kandi = 784 lbs.

carefully collected regarding the variety of cotton grown in the fields selected for the crop cutting experiments, 69 per cent. of the fields in Akola and 94 per cent. in Buldana grew Jarila. These proportions are in close agreement with the above proportion of Jarila obtained through the usual field inspection by the district land records staff, and demonstrate the representativeness of the fields selected for the crop cutting survey.

There was a considerable cotton traffic across the district borders and, due to the popularity of cotton markets in Buldana, cultivators from afar brought their cotton into this district for sale. The largest import was from the neighbouring district of Akola, amounting to over 32,000 kandies of kapas. In computing figures for import and export from primary data, factors such as the relation between local weights and standard weights and the discrepancies between the reported weight and the true weight of a cartload of cotton had to be taken into account. The report of the Director of Land Records contains several interesting details connected with this work. Carryover of unginned kapas to next season was quite small. Figures for the carryover from the previous season were not collected as being negligible owing to the high prices of the previous season. The inquiry into the domestic consumption of cotton is not yet complete though here again the amount of cotton involved is thought to be trifling. The movement of kapas is apparently the most important factor affecting ginning returns. On the information available, the calculated yield per acre for Buldana shows a very close agreement indeed with the estimate obtained from the crop cutting survey, while in Akola the calculated yield is quite within the limits upto which the yield estimate from crop cutting may fluctuate through chance causes, these limits ($281\cdot6 \pm 26\cdot4$) being defined by the standard error. We may conclude that in both districts the reliability of the yield estimates derived from the crop cutting survey has been amply borne out through a comprehensive independent check.

The degree of accuracy to be aimed at in planning future surveys needs some consideration. The trade is interested in accurate production estimates of large blocks comprising of several districts, rather than of individual districts. The past two seasons' surveys were limited to one or two districts and a standard error of the order of 5 per cent. of the mean yield was reached. In extending the survey to larger areas, a higher degree of accuracy which would reduce the margin of error is clearly necessary to ensure trustworthiness of the estimate for practical purposes. Estimates with a standard error of only one per cent. may be reasonably demanded, but it does not seem possible to attain this degree of accuracy for rainfed cotton without excessive sampling. The amount of sampling needed for estimating the yield with varying degrees of accuracy, as indicated from past results, is shown below:

Number of villages required for survey with four fields per village and one plot of one-tenth acre size per field

	1% s.c.	2% s.c.	3% s.c.
Akola results, 1942-43 ..	1850	463	206
Akola results, 1943-44 ..	1188	297	132
Buldana results, 1943-44 ..	1556	389	173

With four fields to be sample-harvested in each village, crop cutting will have to be done in upwards of twelve hundred villages in each block whose production is required to be estimated with a standard error of one per cent. The cost will ordinarily be prohibitive. In Central Provinces and Berar where cotton is grown in 34 tahsils in ten districts, this will mean harvesting sample plots in some 35 to 40 villages in each tahsil. On the other hand, a slightly lower standard of accuracy seems attainable in practice. Enough sampling can be managed to estimate yield with a standard error between 2 and 3 per cent. In irrigated areas and with less variable crops than cotton such as cereals, the position is probably better. Crop cutting experiments carried out on rain-

fed wheat in Central Provinces and on irrigated wheat in the Punjab in the year 1943-44 have indicated that a definitely higher standard of accuracy than is attainable with rainfed cotton can be aimed at in planning yield surveys on cereals particularly in irrigated tracts.

With the object of estimating the average yield and the total production over the whole cotton area in Central Provinces and Berar, it is proposed to carry out a crop cutting survey in the current season at an estimated cost of Rs. 35,627. This will serve as a large-scale demonstration of the method. When the operations are taken up as a routine by the regular staff of the departments concerned, the cost will be considerably reduced. In order to train the personnel, part of the field staff in this year's survey is to be recruited from the Land Records Department while additional district staff from the revenue and agricultural departments will be trained during the progress of the field work. The survey will extend over 29,829 sq. miles and cover approximately three million acres under cotton representing over 99 per cent. of the total provincial area under this crop. Six random villages per tahsil on an average, or 204 villages in all, will be selected and a single plot of one-tenth acre size will be harvested in four cotton fields in each village. The actual number of villages to be selected will be distributed among the different tahsils in accordance with the area under cotton in each tahsil. This will increase the accuracy of the final estimate by reducing the error of the yield estimate in those tahsils, where there is a larger acreage under cotton. The projected survey will form the first step in the right direction in estimating by a reliable technique the production of the most important commercial crop in the country and it is to be hoped that the method will be rapidly extended for estimating yield of all principal crops.

The cotton surveys in Akola and Buldana districts were financed by the Indian Central Cotton Committee.

It is a pleasure to acknowledge the help given by Mr. M. I. Rahim, I.C.S., Director, Land Records, Central Provinces and Berar, which contributed materially to the successful prosecution of the present surveys.

A RAPID METHOD FOR THE MECHANICAL ANALYSIS OF SOILS FOR EXTENSIVE SOIL SURVEY WORK

By N. D. VYAS AND K. C. BATRA

(Imperial Agricultural Research Institute, New Delhi)

FOR carrying out soil survey of the agricultural stations and sub-stations under the control of the Imperial Agricultural Research Institute, New Delhi, some method for the mechanical analysis of soil had to be adopted. Of the methods in vogue, the one known as Puri's method has gained much importance because of its rapidity and is probably one of the best methods so far as its applicability to pedological studies is concerned, but from practical point of view, this presents certain drawbacks. In the first place the whole of the soil clay is converted into sodium clay and

thus it does not show actual field behaviour. Secondly the saturation capacity of a soil or its moisture equivalent, which bear close relationship with the clay content do not show any relationship with the clay content obtained by Puri's method. On the other hand, such relationship is clearly brought out when the clay is estimated by the old Beaker method. Thirdly, the method appeared to be lengthy for examining a large number of soil samples at a stretch. It was, therefore, decided that a method which could give comparable results with that obtained by the beaker method

be adopted for the work in question. The greatest disadvantage in the beaker method for which it could not be adopted was the consumption of time. Examination of some of the soils showed that it takes nearly two to three weeks to complete a set of samples. To overcome this it was thought that if the process is reversed probably much time could be saved. Instead of estimating clay followed by silt and sand as in the beaker method it was proposed to estimate sand followed by silt while the clay fraction could be obtained by difference. For this some samples of Delhi soils were examined by both the methods. The results obtained were so concordant that examination of the applicability of the method to other soils was considered desirable. The test was, therefore, carried out with about a dozen soils, collected from the different stations in India. The samples were examined by both the methods, the beaker method and the new method which can be designated as "Beaker-Basin method". The details of these results are given below.

The Beaker Method.—10 gms. of air-dry soil, sieved through 2 mm. sieve, were transferred to 200 c.c. rubber-stoppered cylinder, containing 200 c.c. distilled water. After shaking half a dozen times upside down the cylinder was allowed to stand overnight. Next morning it was put in an end-to-end overshaker for 6 hours.^f The contents were then transferred to elutriation beaker 15 cm. in height and 7.75 cm. in diameter. The volume of the contents was then made upto 10 cm. height with water. The contents were stirred with a rubber-capped glass rod and allowed to stand for 24 hours. The supernatant liquid was then syphoned off and the operation was repeated number of times till the supernatant became clear. Every day's collection of the syphoned liquid was dried in the same dish over the water-bath and finally at 100°C. for 24 hours and then weighed. In this way the total clay content was estimated and not the aliquot as is frequently done. To the beaker water was added to make up the volume to 10 cm. height. After stirring, the sand was allowed to settle for a specified time as allowed in the international method, depend-

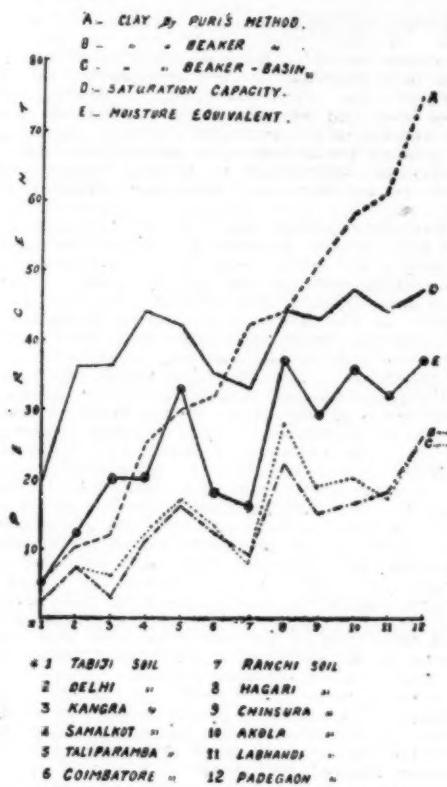
ing on the temperature of the water used. The silt was syphoned off and collected in specimen jars of 4-litre capacity. The operation was repeated till the supernatant liquid became clear. The sediment in the beaker was dried and weighed as sand. The silt was determined in the syphoned liquid by allowing it to stand for 24 hours for each 10 cm. height. The clear supernatant liquid was thrown out and the sediment was dried and weighed as silt.

The Beaker-Basin Method.—All the preliminaries upto the transfer of the contents from the cylinder to the beaker were the same as mentioned above in the beaker method. After making up the volume to 10 cm. and stirring, the liquid was allowed to stand for a specified time as recommended, for the settling of sand, in the International method.^g To be a bit cautious the first two pourings were made after five minutes' standing and the later ones according to the specified time. The operation as usual in such cases was repeated till the supernatant liquid became clear. The residue was dried at 100°C. and weighed as sand. The syphoned liquid containing the silt and the clay was collected in an enamelled basin of five and a half litre capacity with nearly 35 cm. diameter with erect wall so that the sediment settled at the base without sticking to the sides as would be the case in a basin of sloping wall. The basin need not necessarily be exactly of the same size. Any size approaching to the above will do. The volume of the water in the basin was made upto 10 cm. height and allowed to stand for 24 hours. Due to a large volume of water most of the clay was syphoned off in the first operation of syphoning after 24 hours. For subsequent syphoning the volume was made up to 5 cm. height and the period allowed for standing was four hours. In three to four such washings the supernatant liquid became clear. The residue in the basin was dried and weighed as silt. Having determined sand and silt by weights the clay was estimated by difference.

The results obtained by these methods are given in the following table. For the sake of comparison the data obtained by Puri's method are also given in the same table together with

Table showing the mechanical constituents of soils, their saturation capacities and moisture equivalents

	Puri's Method			Beaker-basin Method			Beaker Method				Saturation capacity	Moisture equivalent
	Sand	Silt	Clay	Sand	Silt	Clay	Sand	Silt	Clay	Total		
1. Tabiji soil..	88.31	6.65	5.04	92.2	7.4	2.4	90.0	7.3	1.8	99.1	19.7	5.00
2. Delhi ..	76.91	12.76	10.33	73.8	19.1	7.1	72.2	20.1	7.3	99.6	36.0	11.83
3. Kangra ..	59.63	28.82	11.55	59.5	34.8	5.7	60.9	35.8	3.6	100.3	35.5	20.17
4. Samalkot ..	58.51	16.61	24.88	65.9	23.4	10.7	64.2	25.0	10.6	99.8	43.6	20.17
5. Taliparamba ..	44.30	26.11	29.59	52.1	31.3	16.6	51.6	32.2	16.3	100.1	42.2	32.85
6. Coimbatore ..	61.59	6.74	31.67	67.2	20.0	12.8	67.4	19.6	11.8	98.8	34.5	18.40
7. Ranchi ..	36.71	21.07	42.22	60.2	31.7	8.1	60.4	32.4	8.8	101.6	32.8	15.60
8. Hagar ..	36.56	19.49	43.95	39.6	32.5	27.9	39.3	38.4	22.3	100.0	44.0	37.05
9. Chinsura ..	2.63	48.76	50.61	18.7	62.8	18.5	20.7	64.9	14.8	100.4	43.0	28.78
10. Akola ..	12.37	29.89	57.74	39.6	40.4	20.0	36.7	47.9	16.5	101.1	47.1	36.31
11. Labbandi ..	14.15	25.18	60.07	34.6	48.6	16.8	36.1	47.6	17.8	101.5	43.6	31.97
12. Padegaon ..	8.89	16.36	74.75	35.2	38.4	26.4	28.3	44.4	26.2	99.4	47.3	36.60



the data of the saturation capacities and moisture-equivalent of the different soils.

From the above data it will be seen that the clay content of the soils obtained by Puri's method is higher than by the other two methods which present almost identical results.

As for the correlationship of the clay content obtained by the beaker or the beaker-basin methods with the saturation capacities or the moisture-equivalents, examination of the graph shows that the curves run nearly parallel to one another, but no relationship of these factors could be established with the clay content obtained by Puri's method.

Thus without under-rating the importance of Puri's method which has merits in its own way, it will be seen that for practical purposes the beaker-basin method is more useful where one has to examine a large number of samples within a short period. It is simple, fool-proof and rapid.

Our thanks are due to Rao Bahadur Dr. B. Viswa Nath, D.Sc., F.I.C., C.I.E., and to Dr. S. V. Desai, Ph.D., D.Sc., for their valuable advice during the course of the work.

* Examination of the figures of 104 soils (Briggs, L. J., and McLane, J. W., *U.S.D.A. Bur. Soils Bul.*, 1907, 45, 15-16) shows that a distinct co-relationship exists between the clay content and the moisture equivalent.

† Bouyoucos (*Soil Sci.*, 23, 321) found this period as essential for maximum dispersion. Our own trial with 1, 2, 3, 4, 5, 6, 9, 11 and 24 hours showed that shaking beyond 6 hours had no advantage.

Temperature	Time
20° C.	4 min. 40 sec.
22° C.	4 " 26 "
24° C.	4 " 13 "
26° C.	4 " 1 "
28° C.	3 " 51 "
30° C.	3 " 41 "
32° C.	3 " 31 "
34° C.	3 " 22 "

TECHNICAL PERSONNEL FOR POST-WAR DEVELOPMENT

SIR ARDESHIR DALAL, Member for Planning and Development, in the course of a recent talk to the press on post-war planning, said that the most serious and difficult problem which faced them was the question of trained personnel which was likely to impose well-defined limits to the pace of development. The most essential preliminary step, therefore, was the training of our future scientists, engineers, geologists, doctors, agriculturists, educationists, administrators, etc., in the innumerable different jobs for which they would be required. Our educational institutions would have to be expanded and multiplied, and a generous system of scholarships and research studentships would have to be devised for the training of our men both in India and abroad.

Proceeding he said that it was intended to send a large number of such men for training in the near future to the U.K. and the U.S.A. Mr. Sargent, the Educational Advisor to the Government, had been making investigations in both those countries for that purpose, and a detailed scheme would be worked out after his return. One of the most urgent needs of the country was the training of geologists and an increase in the existing personnel of the Geological Department. Our universities should take up the question of geological teaching as an urgent measure. The establishment of a very high-grade technological institute on the lines of the M.I.T. in America, as well as of an All-India Medical Centre, were under consideration.

THE SEVENTH WRIGHT BROTHERS LECTURE

THE Seventh Wright Brothers Lecture was presented before the Institute of Aeronautical Sciences, in the U.S. Chamber of Commerce Auditorium, Washington, D.C., on December 17, 1943, by Mr. W. S. Farren, of the Royal Aircraft Establishment, England. The subject of the lecture was "Research for Aeronautics—Its Planning and Application".

The lecturer in the course of his address dealt with the current problems of aeronautical research and outlined the character of the work of the immediate future. He also drew attention to the changes in the nature of the needed research equipment and organization that have arisen from the maturing of aeronautical development. He stated the aim of research to be twofold, (1) the discovery of how to make better aircraft and (2) to produce a theory firmly supported by experimental evidence. In a way these two aims are substantially identical. The improvement of aircraft design depends to a large extent on a very clear understanding of the nature of fluid flow under different conditions, the elastic and plastic behaviour of the materials of the structure and the production of power for propulsion. In brief, better aircraft are a result of the building-up of rational theories firmly supported by experimental evidence.

The achievements of the past twenty-five years in aeronautical research and their application to aircraft were graphically illustrated by a comparison of the S.E. 5, a single-seat fighter of the first World War, with the modern Spitfire, and the Handley Page O/400 twin-engined heavy bomber with the present-day Lancaster. The substantial reduction in the drag, increase of the power and the improvement of structural design were demonstrated with the help of the available data. The structural developments had been the result of outstanding contributions of research in the field of metal monocoque design, both theoretical and experimental.

The lecturer commented on the better status, to-day, of our knowledge of the stability and control characteristics of aircraft, and on the power plant development of recent years. The problems of the immediate future were pointed out to be concerned chiefly with compressibility effects arising from high speeds at great altitudes. Some new data on the effect of compressibility on drag as influencing the true level speed at various heights were presented. Also the critical character of the wing loading

as a function of height was indicated with the help of a diagram.

Mr. Farren emphasised the necessity for close co-ordination among the research workers, the designer, the constructor and the user, in providing information that might be used to improve future designs. From aerodynamics there is the demand for specific information 'covering the whole aeroplane including its propulsion, stability and control'. Structural research should provide schemes of design necessary for precision of form and superficial smoothness, and also discover methods to cope with new strength and stiffness requirements. Again, 'in the future it will be impossible to consider the aeroplane engine and the aeroplane as separate enterprises with conflicting requirements'. The thermo-dynamic problems will be aerodynamic also. Their joint solution will throw up more than enough of the design problems at which the power-plant engineer excels. The aeroplane designer will have to combine the contributions of all the rest into a working proposition. His task will be to provide for pressurized cabins, ice-free surfaces and the large number of new and indispensable aids to control navigation, take-off and landing. The user of aeroplanes also has a responsible role, namely, to encourage the research worker and the engineer in their difficult tasks and to support them to the full with resources in men and material. He has also the duty of contributing operational information that will guide their efforts.

In conclusion, Mr. Farren pointed out that although a great many problems of to-day will require equipment of very large size and complexity, there is still great scope for research workers on a small scale. In any case, all aeronautical research should be a co-operative effort where the assembling and co-ordination of the results of the various groups of workers is of the utmost importance. The solution of each type of problem will naturally be the primary responsibility of groups of specialists, each under a leader. The parts, however, must be welded into a whole and in this welding lies the problem of management for large aircraft establishments. Reviewing the work of the past few years, Mr. Farren felt justified in being perfectly satisfied with the record of achievement and optimistically believed in the complete success of the present effort 'in which the share of research is to provide information by which aircraft and their equipment can be steadily improved and used to greater effect'.

THE INDIAN SCIENTIFIC MISSION

AT the invitation of His Majesty's Government, a Scientific Mission consisting of seven Indian scientists are expected to proceed to England during the first week of October. Sir S. S. Bhatnagar, Sir J. C. Ghosh, Col. S. L. Bhatia, Dr. Nazir Ahmad, Prof. M. N. Saha, Prof. J. N. Mukherjee and Prof. S. K. Mitra

constitute the delegation. The Mission will also visit the United States and possibly the Dominion of Canada.

The principal object of the Mission will be to establish contacts with the scientists of allied nations and "to plan arrangements for collaboration and exchange".

LETTERS TO THE EDITOR

	PAGE	PAGE
A New Method for Determining the Elastic Constants of Crystals. By S. BHAGAVANTAM AND J. BHEEMASENACHAR		
Photo-Electric Estimation of Nickel in Alloy Steels. By G. V. L. N. MURTY AND N. B. SEN	229	234
A Broth Cholera Vaccine. By S. S. SOKHEY AND M. K. HABBU	229	234
Urinary Excretion of Sulphanilyl-Benzamide. By A. N. BOSE AND J. K. GHOSH	230	235
Estimation of Adrenaline by Van Slyke Manometric Technique. By U. P. BASU AND N. RAY	230	236
Antioxidants for Shark Liver Oil. By P. V. NAIR AND T. A. RAMAKRISHNAN		
Sympathomimetics of the Naphthalene Group. By S. RAJAGOPALAN AND K. VENKATACHALAM	232	237
Fatty Oil from the Seeds of <i>Mappia foetida</i> (N.O.: Olacaceae). By M. D. NADKARNI, J. W. AIRAN AND S. V. SHAH	232	238
A Preliminary Note on 'Polyporin'. By S. R. BOSE AND ANIL C. CHOUDHURY	233	239
Tip-Burn of <i>Piper betle</i> in the Central Provinces. By R. P. ASTHANA AND K. A. MAHMUD		
Vernalisation of Mustard. By B. SEN AND S. C. CHAKRAVARTI		
Self- and Cross-Incompatibility in Some Diploid Species of <i>Solanum</i> . By B. P. PAL AND PUSHKARNATH		
Effect of Mercury on Micro-organisms. By JAGJIVAN SINGH		
Fertilisation in <i>Isoachlya anisospora</i> (de Bary) Coker var. <i>indica</i> Sak et Bhar. By K. S. BHARGAVA	231	236
Final Pelagic Larva of <i>Squilla Hieroglyphica</i> Kemp. By K. H. ALIKUNHI		
Occurrence of a <i>Stauromedusa</i> on the Indian Coast. By N. KESAVA PANIKKAR		
The Food of Ribbon-Fish <i>Trichiurus</i> spp. By R. S. VENKATARAMAN		
Acclimatisation of Salt-Water Mullet <i>Mugil seheili</i> to Fresh-water. By R. S. VENKATARAMAN		

A NEW METHOD FOR DETERMINING THE ELASTIC CONSTANTS OF CRYSTALS

In the well-known work of Voigt,¹ the elastic constants of crystals were determined by static methods. Recently Bergmann and others,² Atanasoff and Hart³ and Suryanarayana⁴ have used for this purpose certain dynamical methods employing high frequencies. We have now developed a slightly different and highly useful method based on the transmission of ultrasonic waves through crystal plates.

A suitably cut and silvered quartz or tourmaline wedge of a small angle is used in a high frequency circuit in the usual manner as a source of continuously varying ultrasonic frequencies. The oscillations of the wedge are made to pass through a crystal plate and thence into a liquid like CCl_4 . The waves thus set up in the liquid are used to produce a Debye-Sears diffraction pattern. The intensity of the diffraction pattern will be a maximum when the sound wave has the maximum strength and this occurs for frequencies which are transmitted preferentially through the crystal plate. The lowest of them is related to the effective elastic constant c_{33}' by the

to the effective elastic constant C_{xx} by the relation $\nu = \frac{1}{2d} \sqrt{\frac{C_{xx}}{\rho}}$ where d and ρ are the

thickness and the density of the crystal respectively. Knowing the thickness and the density and measuring the frequency with the help of a wave meter, the effective elastic constant is easily calculated.

In a set of trial experiments on aluminium plates, it has been found that the maxima could be quite definitely located and some

test measurements gave the effective elastic constant to be 11.8×10^{11} dynes per sq. cm., which compares very well with the value 11.7×10^{11} calculated for this substance from the known values of its Young's modulus and rigidity.

In crystals, a sufficiently large number of plates of known orientation have to be investigated upon in order to obtain the complete set of elastic constants. We are extending this method to such cases and amongst the substances thus studied by us is the important crystal of diamond. The fuller results for this and other substances are being reported elsewhere.

1. Voigt, W., *Lehrbuch der Kristallphysic*, 1928. 2. Bergmann, L., *Ultrasonics and their Scientific and Technical Applications*, 1938. 3. Atanasoff, J. V., and Hart, P. J., *Phys. Rev.*, 1941, **59**, 85. 4. Suryanarayana, D., M.Sc. Thesis, Andhra University, 1944.

PHOTO-ELECTRIC ESTIMATION OF NICKEL IN ALLOY STEELS

In the course of our investigations on photo-electric analysis of alloy steels we experienced that the colour involved in the estimation of nickel by Vaughan's method is highly sensitive to light and temperature. This effect was very pronounced in summer, when out of three or four samples analysed simultaneously the colour invariably faded by the time we came to the last.

Detailed investigations have been undertaken to study the effect of reagent concentration on the intensity and stability of the colour involved. From the results obtained the following generalisations may be made:—

- (1) Increase in the concentration of dimethyl glyoxime results in increased intensity and diminished stability.
- (2) An increase in the concentration of ammonia has practically no effect on the intensity of the colour but has a marked stabilising influence on it.
- (3) Increased intensity and diminished stability are caused by lowering the concentration of Iodine.

In the light of the above observations various alterations in the procedure have been tried with a view to stabilise the colour and the following were found to be most satisfactory:—

- (1) Using 0·2 per cent. solution of dimethyl glyoxime in 80 per cent. "ammonia" instead of 0·1 per cent. solution in 50 per cent. "ammonia".
- (2) Substituting N/15 Iodine for N/10 Iodine.
- (3) Effecting the final dilution with 50 per cent. "ammonia" and not with distilled water.
- (4) Waiting for at least one minute after the addition of Iodine and for two minutes after treatment with the dimethyl glyoxime reagent.

The last item was found to be quite helpful in obtaining reproducible values for the drum differences. Full details giving further particulars will shortly be published elsewhere. Our thanks are due to the Works Manager, The Tata Iron & Steel Co., for permitting the publication of this note.

Research & Control Laboratory,
The Tata Iron & Steel Co.,
Jamshedpur. G. V. L. N. MURTY.
August 24, 1944. N. B. SEN.

1. Vaughan, E. J., The Institute of Chemistry Lecture on "Further Advances in the Use of the Spekker Photo-Electric Absorptiometer in Metallurgical Analysis," 1942, pp. 3 and 4.

A BROTH CHOLERA VACCINE

It has become customary to prepare prophylactic vaccines against bacterial infections from growths of organisms on agar. As recently as 1940, the Cholera Advisory Committee of the Indian Research Fund Association¹ recommended that "the (Cholera) vaccine should consist of a suspension of the vibrios obtained by washing off the growth from a 24-hour agar culture with 0·85 per cent. saline solution". This recommendation was in accordance with the practice of the majority of laboratories preparing cholera vaccine in large quantities. The reason for the preference for growths on agar over growths in broth, must be due to the anxiety of workers to obtain their suspensions of organisms as free as possible from extraneous proteins.

The acute shortage of the supplies of agar in the country, brought about by the outbreak

of war against Japan, led us to investigate the possibility of preparing an effective cholera vaccine from growths in a liquid medium. The success of this effort needed the fulfilment of two conditions: (1) the availability of a liquid medium as free as possible from proteins and yet yielding good growth of the vibrio, and (2) the development of a reliable method of testing the protective power of the vaccine in experimental animals. In the acid hydrolysate of casein of Mueller and Johnson,² we have found an excellent liquid medium for the purpose. It gives a profuse growth of the vibrio, is easy to prepare, does not give biuret reaction, and what is more, costs less than half to prepare than the usual laboratory nutritive broths. We have been able to develop a protection test in white mice which gives repeatable results within narrow limits. Our mouse protection test determines the minimal dose of the vaccine required to protect 50 per cent. of the immunised mice against an infective dose of 10 m.l.d.'s administered intraperitoneally with mucin.³

In the several experiments we have performed so far the vaccine prepared from cultures in the liquid medium incubated at 28° C. for seven days, killed and preserved with phenyl mercuric nitrate, 1 mg. per 100 ml., gave a mouse protective dose of 0·00003 ml. Against this, the customary cholera vaccine made from 24-hour agar cultures of the same strain containing 8,000 million organisms per ml., gave a mouse protective dose of 0·0004 ml. Further our vaccine has a low toxicity, as much as 1·5 ml. per mouse (18-20 gm.) produced no deaths. However, we are working to still further detoxicate it by the addition of formalin. 0·8 ml. of agar vaccine killed four out of five mice.

The new cholera vaccine we have described is about ten times as potent as the customary agar culture vaccine, has low toxicity and has the great merit of being easier to prepare in large quantities than the agar culture vaccine. Haffkine Institute, S. S. SOKHEY. Bombay, M. K. HABBU. September 9, 1944.

1. Taylor, J., 'Cholera Research in India, 1934-40, under the Indian Research Fund Association, A Review,' The Job Press, Cawnpore, 1941, pp. 37-38. 2. Mueller, J. Howard, and Johnson, Everett R., *J. Immunol.*, 1941, **46**, 33-38. 3. Griffits, James J., *Pub. Health Rep.*, 1942, **57**, 707-10.

URINARY EXCRETION OF SULPHANILYL-BENZAMIDE

In continuation of our previous work (Bose and Ghosh, 1944)¹ where the toxicity and blood concentration of sulphanilyl-benzamide were studied, the present work was undertaken to find out the amount of urinary excretion of the drug in human volunteers. Along with this, the excretion of sulphanilamide was also studied for comparison.

Four laboratory workers volunteered for the study. Two of them were fed orally with 1 gm. of sulphanilyl-benzamide two hours after their morning meal. The other two volunteers were similarly fed with sulphanilamide. The

Urinary excretion of Sulphanilyl-Benzamide and Sulphanilamide in human beings
Dose of each drug = 1 gm. orally

Name of Drug	Volunteer No.	Sample in hours	Total drug excretion in mg.		Percentage excretion of drug in 3 days		
			As free	As conjugated	Total	Free	Conjugated
Sulphanilyl benzamide	1	24	330·2	157·6	70·4	59·3	40·7
		48	78·7	93·1			
		72	8·7	35·1			
	2	24	446·4	233·2			
		48	52·9	107·9	87·6	57·0	43·0
		72	..	46·2			
Sulphanil-amide	3	24	213·2	240·6			
		48	94·0	107·0	71·5	46·7	53·3
		72	25·2	34·8			
	4	24	256·0	475·6			
		48	74·2	168·4	97·4	34·2	65·8
		72			

total 24 hours' urine was collected for three successive days, and the excretion of the drugs both as free and conjugated forms was estimated daily according to the modified technique of Marshall and Litchfield (1938).² The table gives the result of this investigation.

The observations on the urinary excretion as given in the table amply corroborate the rapid systemic absorption of sulphanilyl-benzamide in man (cf. Bose and Ghosh, 1944). The average percentage of the total excretion of the drug as apparent from the table was 79 per cent. in 72 hours, which indicate a fair amount of absorption and a moderately rapid excretion. Moreover, it is being found that the excretion of the drug is more as free (58 per cent.) than as conjugated from (42 per cent.). But in the case of sulphanilamide the reverse is being observed. Considering the excretion of sulphanil-benzamide more in the free state it is considered to be of interest to study the effect of this drug in different urinary infections.

The compound being a benzoyl derivative, it would also be worthwhile to study the excretion of hippuric acid, which might give a clue to the possible nature of its breakdown in the system. Work is already in progress.

A. N. BOSE.

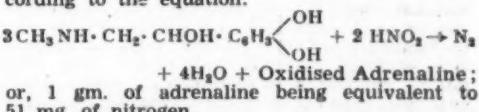
J. K. GHOSH.

Bengal Immunity Research Laboratory,
August 26, 1944.

1. Bose, A. N., and Ghosh, J. K., *Ind. Jour. Med. Res.*, 1944, **32**, 61. 2. Marshall, E. K., Jr., and Litchfield, S. T., Jr., *Science*, 1938, **88**, 85.

ESTIMATION OF ADRENALINE BY
VAN SLYKE MANOMETRIC
TECHNIQUE

PURE adrenaline is usually determined by Folin's method as modified by Culhane and Underhill.¹ The significance of the observations of Barker, Eastland and Evers² that ascorbic acid as present in suprarenal gland interferes in the oxidation of the catechol grouping as present in the adrenaline molecule, is now obsolete as most of commercial adrenaline is being produced synthetically and as such free from ascorbic acid. As Folin's method is virtually dependent on the oxidation of catechol part by the phenol reagent, it was thought that the same phenomenon may happen in presence of nitrous acid with the liberation of nitrogen gas (cf. Carter and Dickman³). The latter may then be an easy measure in the estimation of an adrenaline solution according to the equation:



On this basis 0·1 per cent. solution of pure adrenaline hydrochloride was treated with nitrous acid in Van Slyke micro-apparatus by the customary method as followed in usual Van Slyke amino nitrogen estimation. The acid reacted vigorously with the adrenaline solution with evolution of gas which was collected, washed with alkaline permanganate and the volume of residual gas left behind, was

noted. A control without addition of adrenaline was also made in each experiment. The difference in the two readings at N.T.P. gave the amount of nitrogen gas formed during the reaction. From this the weights as recorded in the table below, were calculated out:—

Pure Adrenaline—0.1 per cent. solution.

Time of Reaction—40 minutes.

Period of Absorption—30 minutes.

Expt.	Adrenaline		Nitrogen in mg.		Percentage of error
	c.c.	mg.	found	calculated	
1	1	1	0.0523	0.051	2.54
2	2	2	0.1046	0.102	2.55
3	3	3	0.1576	0.153	3.0

From the table it seems that the above reaction between nitrous acid with adrenaline solution (0.1 per cent.) is practically quantitative. The reaction is being further studied for finding out an easy process of assaying liquor adrenalini hydrochloridi which is also a 0.1 per cent. solution of pure adrenaline.

Bengal Immunity Research
Laboratory, Calcutta,
September 6, 1944.

U. P. BASU.
N. RAY.

1. Analyst, 1932, 57, 696. 2. Biochem. J., 1932, 26, 2129. 3. J. Biol. Chem., 1943, 149, 571.

ANTIOXIDANTS FOR SHARK LIVER OIL

The present investigation is primarily concerned with increasing the storage life of Travancore shark liver oils by addition of antioxidants. Antioxidant properties of 2-O-(O-tri-acetyl)-galloyl phloroglucinaldehyde, gallic acid, and hydroquinone have been studied and the results are given in the table below. The peroxide values were determined by Wheeler's titrimetric method (1932) suitably modified for our requirements. The results are expressed as milli-equivalents of peroxides per kg. of oil.

TABLE I
Effect of different antioxidants on rancidity development in shark liver oil

2-O-(O-tri-acetyl) galloyl-phloro- glucinaldehyde (0.067%)	Hydroquinone (0.086%)		Gallic acid (0.069%)					
	Time in days	Uninhibited	Time in days	Uninhibited	Inhibited	Time in days	Uninhibited	Inhibited
0	7.0	7.1	0	16.3	15.3	0	8.5	6.4
2	36.8	11.0	2	33.2	15.4	2	29.8	10.8
4	270.4	12.1	4	202.1	15.4	4	46.3	12.6
5	332.1	12.2	6	235.4	15.4	6	69.8	24.1
7	537.8	16.7	10	565.0	21.6	12	419.7	43.0
9	664.6	16.0						

It will be seen that 2-O-(O-triacyetyl)-galloyl phloroglucinaldehyde is far more effective than gallic acid and fairly comparable in its activity with hydroquinone.

Some of the other chemical antioxidants which have been tried by us include O-p-nitrobenzyl-6-nitrovanillinic acid, 3-isovanillylidene-7-methoxychromanone and p-acetoxycinamonyl phloroglucinaldehyde, nearly all of which furnished indifferent results. The 'inhibitrol' concentrates of a few oil-meal extracts were examined for their antioxidant activity and of these the seeds of *Mucuna pruriens* furnished an extract of mild antioxidant character. Further work on the examination of the antioxidant properties of various vegetable oils, oil-meal extracts, and inorganic and organic compounds is in progress.

Dept. of Applied Chemistry,

University of Travancore,

Trivandrum,

July 18, 1944.

P. V. NAIR.

T. A. RAMAKRISHNAN.

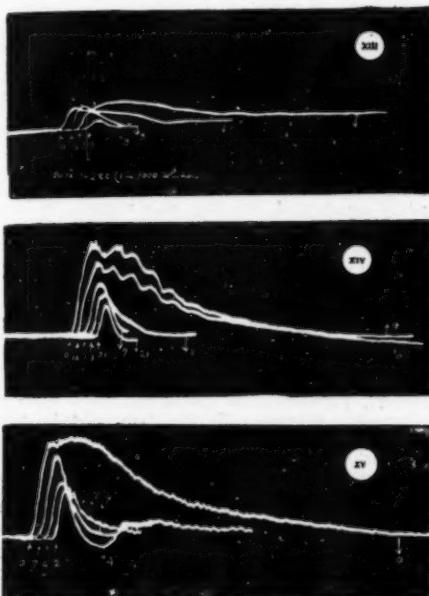
1. Wheeler, D. H., Oil and Soap, 1932, 9, 39

SYMPATHOMIMETICS OF THE NAPHTHALENE GROUP

As early as a quarter of a century ago, Madinaveitia¹ reported that the mere substitution of the naphthalene ring in place of the customary benzene nucleus of the familiar sympathomimetics resulted in an augmentation of activity by over forty times. However, the above report was based on the comparison only of a single pair of analogous compounds belonging to the benzene and naphthalene series which possess the accepted structures for sympathomimicity. Although a few aminoethane derivatives of naphthalene have been reported in literature as probable sympathomimetics from time to time by other workers,² no effort has yet been made by any of them either to duplicate Madinaveitia's results or to explore the interesting possibilities held out by his highly significant observation by systematic synthesis and study of aminoethane derivatives of poly- and hetero-cyclic ring systems. An essay in this direction recently made by us consisted in the biological examination of a collection of twenty-one compounds,³ severally derived from the naphthalene, acenaphthene, phenanthrene and isoquinoline nuclei and possessing the requisite structures necessary for sympathomimetic activity.

The results obtained indicated that an intensive search for possibly promising sympathomimetics has to be made particularly in the naphthalene series: these results as well as the experimental technique adopted have already been communicated.⁴ Meanwhile, such of the naphthalenic compounds which showed activity in the earlier study have been subjected to re-examination in respect of their pressor activity in the spinal cat, using tyramine hydrochloride (Serial No. 0) as the control. The compounds now studied are the hydrochlorides of β , β -1:1'-dinaphthyl, β -hydroxy ethylamine (No. 1), β , 2-naphthyl, β -hydroxy ethylamine (No. 2), α -amino, β -acetoxynaphthone (No. 3), β -1-naphthyl, β -hydroxy

ethylamine (No. 4), ω -amino, α -acetonaphthone (No. 5), β , 1-naphthyl ethylamine (No. 7), 4-hydroxy, ω -aminoacetonaphthone (No. 9), N, N'-trimethylene bis-tyramine (No. 14) and 4-hydroxy naphthyl ethylamine (No. 21). These compounds were divided into convenient groups which were each compared with tyramine in the same animal. The results obtained are embodied in the kymograph tracings of the blood-pressure, entitled graphs XIII-XV.



The dosage consisted of 1 c.c. of a one-in-thousand solution of each of the drugs, corresponding to one mg. of the hydrochlorides, in two of the experiments (Graphs XIV and XV). The administration of doses of 2 c.c. in one experiment gave rise to the Graph XIII.

The present set of graphs serve to reveal the active pressor amines which appear to merit further detailed study. These are β , β -1:1'-dinaphthyl, β -hydroxy ethylamine (No. 1), β , 2- and β , 1-naphthyl, β -hydroxy ethylamines (Nos. 2 and 4), ω -amino- α -acetonaphthone (No. 5), β , 1-naphthyl ethylamine (No. 7) and N, N'-trimethylene bis-tyramine (No. 14).

Whether any of the six aforementioned compounds is likely to find a place in medicine will be settled by their complete pharmacological examinations now in progress

Dept. of Pure & Applied Chemistry,
Indian Institute of Science,

Bangalore,
The Research Unit,
Medical College,
Madras.

S. RAJAGOPALAN.

September 12, 1944.

K. VENKATACHALAM.

1. Madinaveitia, *Bull. Soc. Chim.*, 1919, **25**, 601;
Annal. Fiz. Quim., 1920, **18**, 66. 2. Windaus, *Ber.*,

1917, **50**, 1120; Meyer et al., *Ibid.*, 1922, **55**, 1855; Day and Collaborators, *J. Organic Chem.*, 1940, **5**, 512; 1941, **6**, 384. 3. Rajagopalan, *J. Indian Chem. Soc.*, 1940, **17**, 567; *Proc. Indian Acad. Sci.*, 1941, **13**, 566; 1941, **14**, 126; 1944, **20**, 107. 4. —, and Venkatachalam, *Proc. Indian Acad. Sci.*, 1944, **20**, in press.

PATTY OIL FROM THE SEEDS OF *MAPPIA FOETIDA* (N.O.: Olacaceae)

THE fruit of *Mappia foetida* (Marathi: *Kalgur*; *Ghamera*) was collected for this investigation from the Dajipur forests, about forty miles south-west of Kolhapur, in the Western Ghats. It is a small ellipsoidal fruit resembling *Jambul* fruit in colour and in appearance and hard shell, is uncovered and yellowish white in colour.

The seeds of the dry ripe fruit were crushed and the oil was extracted with benzene in a soxhlet. The solvent was then removed by distillation, the last traces of it being removed under vacuum. The oil is reddish yellow and has a slight fluorescein. On examination it gave the following physical and chemical constants:—Yield, 48 per cent; specific gravity at 27° C., 0.9319; refractive index at 27°, 1.4781; acid number 3.7; saponification value, 185.4; iodine value (Wijl's method), 45.6; Reichert-Meissel value, 0.68; Polenske number, 0.41; acetyl value, 5.77; unsaponifiable matter, 0.81 per cent.

Chemistry Department,
Rajaram College,
Kolhapur,

M. D. NADKARNI.
J. W. AIRAN.
S. V. SHAH.

July 29, 1944.

A PRELIMINARY NOTE ON 'POLYPORIN'

By growing a *Polyporus* in Czapeck-Dox medium (pH 7) at room temperature (29° to 32° C.), a filtrate through Seitz-filter has been obtained which has been tested to be highly bactericidal. When the filtrate in the concentration of 1 to 20 is poured in a broth culture of *Staphylococcus aureus*, the latter becomes clear in the course of four to five days with a little sediment at the base of the tube. A subculture of the sediment after nine days shows no growth in the broth-culture tube when examined both visually and microscopically.

The animal-experiment of the whole filtrate proved to be completely non-toxic, the animals employed were guinea-pigs with one control in each case. The filtrate has pH value of 5.8 and it retains its potency at 22° to 28° C. (room-temperature) for about a month as far as we have been able to test.

Genetic change is not possible in this group of fungi by application of chemicals or strong doses of ultra-violet, X-ray and radium.¹

Chemical isolation of the active principle of the filtrate is being attempted. Clinical trials of the crude filtrate on ulcers and surgical abscesses of a few patients have been very

encouraging. Further work on different aspects is actively proceeding.

This work is being kindly financed by the Indian Health Institute and Laboratory, Ltd., Calcutta.

Botanical and Pathological Lab.,
Carmichael Medical College,

Calcutta, S. R. BOSE.
August 23, 1944.

ANIL C. CHOUDHURY.

1. Bose, S. R., *La Cellule*, 1934, Tome 42 and *J. Ind. Bot. Soc.*, 1938, 17.

TIP-BURN OF PIPER BETLE IN THE CENTRAL PROVINCES

TIP-BURN, a physiological disease of *Piper betle*, has been observed to cause considerable damage to the crop in this Province during the hot and dry months. The disease is characterised at first by wilting of the tissues at the extreme tips or sometimes at the margins, followed later by a browning and death of the tissue (Fig. 1). These dead and brown-coloured patches later turn hard and brittle and



FIG. 1. Tip-burn of *Piper betle*

are often broken or torn. A part or the whole of a leaf may succumb to this disease. Unlike fungal or bacterial infections the diseased leaves do not drop off but remain attached to the vines in a flaccid condition. Young and immature leaves are more severely affected than the old and mature ones. *Kapuri* variety of pan, whose leaves are of softer and thinner texture, has been observed to be highly susceptible to this disease than *gangeri*, *kakher* and *bangla* varieties with thicker leaves. *Bangla* variety of pan has been observed to be most resistant of all the varieties under observation. It has been further noticed that

leaves on the vines affected with foot-rot disease (*Phytophthora parasitica* var. *piperina* Dast.) with poor root system succumb more readily to tip-burn than those on healthy plants.

The disease is caused by excessive loss of moisture from the leaves due to hot and dry weather conditions which prevail during the months of March to June in this Province. It is first observed towards the end of March or beginning of April and reaches to its maximum severity about the middle of May. The incidence of the disease is not marked after the rains set in. Repeated isolations from the diseased portions have given negative results about the presence of any pathogenic micro-organism.

It has been worked out and experimentally shown that this tip-burn disease could easily be kept in check or its incidence considerably reduced if the *barejas* (pan gardens) are properly shaded at the top, the vines are lowered latest by the second week of March and the garden is kept moist by adequate irrigation during the hot and dry months.

Agricultural Research Institute,

Nagpur,
July 21, 1944.

R. P. ASTHANA.
K. A. MAHMUD.

VERNALISATION OF MUSTARD

In their note on "Studies on the Physiology of Mustard", published in the June 1944 number of *Current Science*, J. C. Sen Gupta and N. K. Sen have reported their interesting observations on photoperiodic and vernalisation studies with *Tori* No. 7 and *Rai* No. 5. The authors observed that *Rai* No. 5 sown on September 1, 1943, took 46 days to flower, whereas from a sowing of November 15, 1943, flowers were observed in 27 days. On the basis of this observation the authors have concluded that "the vegetative period shortens with lower temperature". But further on in their note, they state that "*Rai* shows a lengthening of vegetative period with the shortening of the light period and a greater shortening of the vegetative period is observed with increased temperature range and this confirms Sen and Chakravarti's findings (1942)." It is difficult to reconcile these two statements which appear to be directly contradictory. As a matter of fact, it has been our experience that, under otherwise similar cultural conditions, lower temperature invariably lengthens the vegetative period.

The authors observed the effect of prechilling of "soaked unsprouted seeds" of *Tori* and *Rai* at 2-4° C. for 10, 20 and 30 days. They state, "Sen and Chakravarti (1942) have reported a clear earliness of flowering in mustard due to presowing low temperature treatments. The results reported here do not confirm their findings . . ." In reply, we wish to point out that we have never asserted that all strains of mustard will respond to vernalisation, but we³ have stated that all the five strains of mustard with which we worked—*T* 27, *C* 11, *C* 9, *raya O/B* I and *yellow sarson*—do give a very definite vernalisation response. In the Discussion on Vernalisation² held by the I. C. A. R. in December 1939, points strongly

emphasized by one of us were that (i) experimental data must be obtained to find out whether particular strains of a selected crop will or will not respond to vernalisation, (ii) to obtain this information, experiments with different strains of crops should be undertaken in various regions and (iii) the study of the effect of prevailing aftersowing environmental factors of given regions on the life-cycle of both vernalised and untreated seeds is essential to evaluate the practical possibilities of vernalisation for agriculture.

It may well be that Rai No. 5 and Tori No. 7 do not respond to vernalisation but from the experimental work reported by Sen Gupta and Sen no definite conclusion seems to be justified for the following reasons:—

1. The maximum period of chilling used by the authors was only 30 days, a period which at least in the case of five strains of mustard referred to above we have found to induce only incomplete vernalisation. Wide variation in vegetative cycles as reported by the authors for Rai No. 5 and Tori No. 7 is usually one of the characteristics of an incompletely vernalised batch of seeds.

2. The fact that unsprouted soaked seeds were chilled at 2-4° C. for different periods does not in itself ensure that they were properly vernalised. The authors have not given any idea of the conditions of the different batches of seeds after chilling, nor have they described the technique used. To induce effective vernalisation the life-activity of the embryo during the process of chilling must continue. It has been our experience^{1,2} that under effective chilling conditions a certain percentage of seeds in every batch under treatment will invariably sprout, and this is a visual indication that the life-activity of the embryos has not been suspended during the period.

3. There is no evidence that the authors have taken into consideration the full implications of their own final remark, a truism to all students of vernalisation work, "that for any conclusion arrived at, after vernalisation studies, the variety and the post-treatment environmental conditions should always be taken into account". For they have formed their conclusions from the data obtained from a single sowing of Rai No. 5 and Tori No. 7 on October 1, 1943.

Vivekananda Laboratory,
Almora,
July 7, 1944.

B. SEN.
S. C. CHAKRAVARTI.

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SELF- AND CROSS-INCOMPATIBILITY IN SOME DIPLOID SPECIES OF SOLANUM

PAL and Pushkarnath¹ and later Pushkarnath² have presented evidence showing that self- and cross-incompatibility in *S. Caldasii* and *S. subtilius* is genetical and is controlled

by a series of five oppositional factors. Further studies with these two species and with *S. chacoense* and E.P.C. 143 (an unidentified South American variety obtained from the Empire Potato Expedition, probably belonging to *S. subtilius*), have shown the presence of six additional factors which belong to the same allelomorphic series. The experimental evidence, briefly summarised below, shows that these six factors are distinct from the five reported earlier, thus bringing the total to eleven.

1. Family No. D-29—*S. Caldasii* var. 1 × *S. Caldasii* var. 07.—Crossing tests made with 14 F₁ plants gave four intra-sterile groups of plants, A, B, C, D, with 4, 3, 2 and 5 plants respectively, in each group.

2. Family No. D-34—*S. Caldasii* var. 07 × *S. Caldasii* var. 1.—This was the reciprocal of the previous cross and tests made with 15 F₁ plants indicated here also the presence of four intra-sterile groups of plants, W, X, Y and Z, in the proportion of 6, 4, 2 and 3 plants in each group respectively.

Further experiments proved, as was expected, that the A, class of family D-29 was identical, with the Y class of family D-34 and B, with W, C, with X and D, with Z. For this reason plants belonging to the classes W, X, Y and Z were eliminated from further tests.

3. Family No. C. 115—*S. Caldasii* var. 01 × E.P.C. 143.—Seventeen F₁ plants tested gave four groups of intra-sterile plants in the proportion of 4, 4, 6 and 3 plants. These groups of plants were designated as E, F, G, and H, respectively.

4. Family No. C. 198—*S. chacoense* var. 07 × *S. subtilius* var. V.—Out of 20 F₁ plants raised in this family 12 were tested and four intra-sterile groups of plants, I, J, K, and L, established with 2, 5, 4 and 1 plants in each of the groups respectively.

The four families referred to above, thus gave a total of 12 intra-sterile groups of plants (A, to L). Crosses made reciprocally, in all possible combinations, amongst these 12 groups of plants showed that these were cross-compatible, thereby indicating that the constitution of no two groups of plants was identical and that the six varieties used as parents in the above-mentioned series of crosses differed in respect of the pair of sterility factors present.

The genetical constitution of *S. subtilius* var. V, ($S^1 S^3$), *S. Caldasii* var. 01 ($S^1 S^5$) and *S. Caldasii* var. 07 ($S^2 S^4$), which have been used in the above crosses, was already established by our previous studies and it was known that these varieties between them carried five sterility factors. The present series of crosses was designed to discover whether any of these factors was present in the other three varieties used in the crosses.

The plants of the 12 intra-sterile groups (A, to L) when crossed with the ten 'testers' carrying $S^1 S^2$, $S^1 S^3$, $S^1 S^4$, $S^1 S^5$, $S^2 S^3$, $S^2 S^4$, $S^2 S^5$, $S^3 S^4$, $S^3 S^5$ and $S^4 S^5$ combinations of factors gave (with the exception of two doubtful cases) completely cross-compatible reactions. Therefore none of the 12 groups of plants had any of the above combinations of

factors in their constitution. The constitution of the three varieties, *S. Caldasii* var. 1, E.P.C. 143, and *S. chacoense* var. 07 in respect of the sterility factors is, therefore, represented by S^0S^7 , S^6S^9 and $S^{10}S^{11}$ respectively and the 12 intra-sterile groups of plants have the following factorial constitution:-

$$\begin{array}{lll} A_1 = S^2 S^6 & B_1 = S^2 S^7 & C_1 = S^4 S^6 \\ D_1 = S^4 S^7 & E_1 = S^1 S^8 & F_1 = S^1 S^9 \\ G_1 = S^5 S^8 & H_1 = S^5 S^9 & I_1 = S^1 S^{10} \\ J_1 = S^1 S^{11} & K_1 = S^8 S^{11} & L_1 = S^8 S^{11} \end{array}$$

Apart from the above eleven factors it is very likely that there are also other 'S' factors in this allelomorphic series in the diploid *Solanums*. We have already found indications of the presence of some new factors in a sample of potatoes, E.P.C. 142, from the collection made by the Empire Potato Expedition. An exhaustive study is bound to increase their number still further.

The presence of the 'S' series of allelomorphs has been also discovered in two other species, *S. aracc-papa* and *S. Rybini*. The behaviour of both these species in crossing tests, however, does not follow the simple mode of inheritance, as outlined in the oppositional factor hypothesis.

S. Rybini under normal conditions is highly self-incompatible. Twenty-two plants obtained from a natural berry showed irregular behaviour in the crossing tests. The findings of Carson and Howard³ in this connection are interesting. Crosses of this species have been obtained with S^1S^3 plants of *S. tuberosus* and the progenies are under study.

We are grateful to Dr. S. Ramanujam, for helpful suggestions in the course of these investigations.

Imperial Agricultural Research Institute,
New Delhi,

and

Potato and Wheat Breeding Station, Simla,
June 29, 1944

B. P. PAL

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EFFECT OF MERCURY ON MICRO-ORGANISMS

Of all the preventive measures^{1,2} suggested in the storage of grains against insects, the easiest and the most striking is the lethal effect of mercury on the eggs of insects commonly found in places where grains are stored. Besides insects, however, fungi and bacteria also infest these storage places, more particularly under wet conditions.

The effect of mercury on some common types of fungi and bacteria has been investigated.

Pure cultures of a few representative fungi (glucose agar media) and bacteria (beef extract media) were taken and mercury was mixed in some tubes, while in others it was

kept at one end of the test tube. These tubes of pure cultures of the organisms were kept under mercury vapour for about two weeks at a temperature between 25° to 30° C. The growth of these were in no way affected as compared with the untreated controls. Re-inoculations were then made from the mercury-treated cultures; the growth of the organisms occurred as usual.

Botany Department,
Government College,
Lahore.

June 29, 1944.

JAGJIVAN SINGH.

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FERTILISATION IN *I SOACHLYA ANISOSPORA* (de BARY) COKER VAR. *INDICA SAK. ET BHAR.*

THE question of fertilisation in the family *Saprolegniaceae* had been the subject of much controversy for a considerably long time. Earlier workers in the field like de Bary,¹ Humphrey² and Hartog^{3,4,5} held the view that antheridia, though present, were functionless. Trow^{6,7} was the first cytological investigator to demonstrate that fertilisation took place in the family *Saprolegniaceae*. Since then fertilisation has been shown to occur in various genera, viz., *Achlya*, *Saprolegnia*, *Aphanomyces*, *Brevilegnia*, *Leptolegnia* and *Thraustotheca* Wolf, p. 464.⁸ In the genus *Isoachlya* also (Coker),⁹ it has been observed that antheridia and oogonia are present, but no cytological evidence as to the fertilisation has yet been reported.

The material for the present study was obtained from a local pond (Saksena and Bhargava)¹⁰ and was fixed in Raper's chromoacetic acid solution. Serial sections were cut 4 μ thick and were then stained with Gram's stain in the usual manner.

Along with the differentiation and maturation of the oospheres the formation of a multi-nucleate fertilisation tube from each antheridium takes place. Later on the fertilisation tube penetrates the oogonial wall and grows in between the oospheres (Fig. 1, F). When it reaches an oosphere its membrane gets ruptured and a single male nucleus is released into the oosphere. The male nucleus proceeds towards the female nucleus, which is usually located near the centre of the oosphere and the two nuclei come in contact (Fig. 2). The intervening nuclear membranes finally disappear and a fusion nucleus is thus formed. In Fig. 1, the two nucleoli are seen lying side by side in the fusion nucleus. Later on, these nucleoli also fuse.

The present investigation shows that fertilisation takes place in *Isoachlya anisospora* (de Bary) Coker var. *indica Sak. et Bhar.* by the discharge of a single male nucleus from the fertilisation tube into the oosphere, the male nucleus subsequently fusing with the female



FIG. 1. Photomicrograph of a section of an oogonium of *Isoachlya anisospora* var. *indica* showing a multinucleate antheridium (A) attached to the oogonium. A multi-nucleate fertilisation tube (F) and an oospore containing a fusion nucleus (N) with two nucleoli (Nu) are also seen. $\times 1433$.



FIG. 2. Photomicrograph of a section of an oosphere containing male and female nuclei lying side by side. $\times 1433$.

one. Belonging to the family Saprolegniaceae, this is, therefore, another genus and another species in which fertilisation has been demonstrated for the first time.

A fuller account of the process will appear elsewhere.

The work was carried out in the Botany Department of the Allahabad University under the guidance of Dr. R. K. Saksena to whom

the author wishes to express his sincere gratitude.

Birla College,
Pilani (Jaipur State),
July 12, 1944.

K. S. BHARGAVA.

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FINAL PELAGIC LARVA OF SQUILLA HIEROGLYPHICA KEMP.

A NUMBER of species of stomatopod larvae from the Madras plankton have been recently correlated with their specific adults by rearing the final pelagic stage through metamorphosis and subsequent growth in the laboratory.^{1,2} The larval stages of several species that have not hitherto been recorded from the Madras coast are also occasionally caught in the tow-net, showing that all the species of adult stomatopods occurring in any particular locality are not yet known to us.

A single larva in the final pelagic stage was obtained from the tow-net collection on March 5, 1943, and this on metamorphosis was found to belong to the rare Indo-Pacific species *Squilla hieroglyphica* Kemp. The following is a brief account of this larva.

Total length including rostrum = 30 mm.; length of rostrum = 4 mm.; median length of carapace, excluding rostrum = 11.5 mm.; breadth of carapace immediately behind antero-lateral spines = 3.0 mm.; breadth of carapace at base of postero-lateral spines = 5.0 mm.; length of antero-lateral spine = 0.8 mm.; length of zoea spine = 0.6 mm.; length of postero-lateral spine = 3.4 mm.; length of raptorial propodus = 3.9 mm.; length of telson = 3.2 mm.; breadth of telson = 3.0 mm.

The carapace is long and broad, posteriorly covering the proximal half of the seventh thoracic segment. In the mid-dorsal line there is an incomplete longitudinal carina which does not extend upto the conical prominence on which the zoea spine is situated (Fig. 1a). Along the lateral margin there are 8-3 spinules, of which the first is situated near the base of the antero-lateral spine. The distance between the first and second spinules is about three times that between the second and third. The eighth spinule is directed outwards and the distance between it and the ninth is only slightly over that between ninth and tenth. The rostrum is long and slender and without ventral spinules. The postero-lateral spine has a ventral spinule at about one-fourth its length from base, and has its tip reaching the level of the hind margin of the second abdominal segment. The tip of rostrum is superior to the tip of antennular peduncle. The eye stalk is a trifle shorter than the eye proper. The

raptorial propodus has three stout spines and a row of pectinations. The dactylus has only the terminal tooth. Abdominal segments are broader than long; sixth with a pair of submedian dorsal spines. Lateral spines of telson short; denticles—one lateral, 11 intermediate, and 18 submedians on each side (Fig. 1 b). Uropod reaches almost to the base of intermediate spine; basal segment of exopod with three free spines; outer spine of ventral prolongation about one-third the length of the inner, the tip of which projects beyond that of endopod.

Hands of the third, fourth and fifth thoracic limbs are coloured conspicuously yellowish red.

The larva was kept alive in a glass dish of clean sea water, and overnight it metamorphosed into a post-larva, 17 mm. long, having

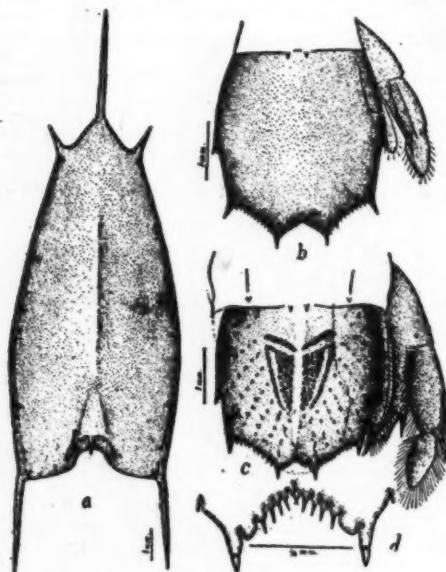


FIG. 1. *Squilla hieroglyphica*

a, final pelagic larva—carapace; b, final pelagic larva—telson and right uropod; c, early post-larva—telson and right uropod; d, early post-larva—submedian area of telson.

undergone a complete moult. Fed regularly, it lived in the aquarium for 8 days and then died while undergoing the first post-larval moult.

In spite of its small size the specimen agrees remarkably well with Kemp's account (1913)³ of *S. hieroglyphica*. The characteristic colouration on the telson, which according to Kemp is unlike any other species, is quite well marked in the young post-larva. On either side of the median carina of telson there are two longitudinal bands of dark chromatophores, the inner one very much broader than the outer, with which it is connected proximally. Close to but distinct from the base of these bands, on either side, is an obliquely

placed narrow band which is even darker in colour (Fig. 1 c). There are five dark spots on the eye stalk, three of them arranged in the form of a triangle, while the rest are placed close to the cornea towards its outer aspect, on either side. The submedian spines of telson are terminally articulated and there are six submedian denticles on each side (Fig. 1 d).

S. hieroglyphica is a rare stomatopod, so far known only from two specimens, the type from an unknown locality (Kemp, 1913), and the second from the Philippines (Kemp, 1915). The present one from the Madras coast considerably extends the range of distribution of this rare species. It is interesting to note in this connection that Schmitt (1940)⁴ records a closely related species, *S. hildebrandi* from the Panama Canal zone.

University Zoology Laboratory,

Madras,
Department of Natural Science,
Maharaja's College,

Ernakulam,

August 24, 1944.

K. H. ALIKUNHI.

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OCCURRENCE OF A STAURONEDUSA ON THE INDIAN COAST

ACCORDING to Mayer¹ and many other students of Scyphozoa, the Stauromedusae are found only in the Arctic and Antarctic regions and in the cold seas; owing to their absence from the tropics the group is often cited as a very noteworthy example of bipolarity in distribution.² It is, therefore, of unusual interest to record the occurrence of a Lucernarian from the Indian coast at the Krusadai Island in the Gulf of Manaar.

In recent years students from colleges at Madras and Trivandrum have made collections of Lucernarians during their study tours at Krusadai. I have been able to examine a number of specimens from these collections. As a detailed account may have to wait till normal publication facilities are again available the significant facts may here be recorded.

The Lucernarian occurring at Krusadai is one of the Eleutheroacarpidae with a well-developed but short stalk and eight marginal lobes, each of which bears a cluster of knobbed tentacles. The general appearance is similar to that of *Lucernaria* usually figured in textbooks and differing from *Haliclystus* in the absence of marginal anchors. The short peduncle is single-chambered and the inter-radial septa projecting into this chamber are devoid of longitudinal muscles. There are well-developed glandular pads on the clusters of tentacles. Owing to these and other characters the species comes under the genus *Lucernariopsis* belonging to the sub-family *Kishinouyeinae*, adopting the scheme of classification proposed by Carlgren.³ This genus is now known from three species, *L. campanulata* of the coasts of Europe and the Mediterranean (which is the common European Lucernaria), *L. capensis*

from South Africa described by Carlgren⁴ and *L. vanhoeffeni*, described by Browne⁵ from the Antarctic. The genus *Lucernaria* includes only species known from the colder regions of the Atlantic. Both these genera are unrepresented in Japanese coasts where a number of other interesting Stauromedusae are known.⁶ Now that this rare group of Coelenterates is known from the Krusadai it is hoped that a more intensive search will be made for Lucernarians in other coastal regions of India. It would appear that the group is not so strictly bipolar as is commonly assumed. The possibility of these meduse, being brought to the tropical zone by means of cold currents from the south also needs careful study.

University Zoology
Research Laboratory,
Madras,
August 15, 1944.

N. KESAVA PANIKKAR.

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THE FOOD OF RIBBON-FISH *TRICHIURUS. spp.*

THE Ribbon fishes, commonly known as "Thalayan" on the west-coast of our Presidency, are ribbon-like in appearance possessed of an elongated body, which is compressed from side to side. These fishes afford a good fishery from September to end of November, after which period catches are very poor upto end of March.

The study on the food of the Ribbon-fish was based upon a systematic examination of the stomach contents of 281 specimens of *T. savala* (Cuv. and Val.), 208 specimens of *T. haumela* (Forsk) and 2 specimens of *T. mucicus* (Gray). This has established the fact that Ribbon-fishes are mainly carnivorous in their feeding habits. Besides, it has been possible to infer from the many observations made, that their appetite is something insatiable. Several specimens when examined showed the stomach unusually distended and gorged with foodmaterials in different stages of the digestive process.

Coupled with the voracity for eating, these carnivorous fishes exhibit a total lack of choice as regards their food. So indiscriminate is their feeding habit, that sometimes, their abundance may have some adverse effect on other fisheries. For instance, the samples of *T. savala*, examined on 10th September 1943, revealed the stomach to be literally clogged with mace-rated fish-eggs, which feature would very likely hit other fisheries.

Prawns and White-baits constitute their favourite food, for these were invariably found in all stomachs. Ribbon-fishes are so partial to prawns and white-baits that they pursue them for long distances. Ribbon-fishes since they follow shoals of white-baits and prawns have been profitably hauled by fishermen in those localities where prawns and white-

baits abound. Besides, statistics point out that there is some relation between the fishery of Ribbon-fish and white-bait, for when the white-bait fishery is poor, than that of Ribbon-fish is also comparatively little.

The other items of food found in their stomach are given below:-

1. Sardine (*Sardinella fimbriata*).
2. Silverbelly (*Leiognathus splendens*, *L. bindus*).
3. Sole (*Cynoglossus semifasciatus*).
4. Big-jawed Jumper (*Lactarius Lactarius*).
5. Rainbow-sardine (*Dussumieri hasselti*).
6. Anchovy (*Engraulis myoxo*, *E. dussumieri*).
7. Glass-fish (*Ambassis dayi*).
8. Grunter (*Pristipoma spp.*).
9. Horse-Mackerel (*Caranx spp.*).
10. White Sardine (*Kowala thoracata*).
11. Jew Fish (*Sciaena spp.*).
12. Fish Larvae, Eggs, Sand-grains.

Marine Biological Station,
West-Hill,
March 12, 1944. R. S. VENKATARAMAN.

* Published with the kind permission of the Director of Industries and Commerce, Chepauk, Madras.

ACCLIMATISATION OF SALT-WATER MULLET *MUGIL SEHELI* TO FRESH WATER†

DEVANESEN AND CHACKO* have shown how fry of Mulletts—*Mugil troschelli* and *M. waigiensis* taken from the sea—can be acclimatized to the freshwater conditions at Krusadai Biological Station. Commenting on this note Hora has pointed out the great practical importance of culture of these fishes in the areas adjoining the sea-shore. This note embodies the results of acclimatisation of a common Mullet along the West Coast—*Mugil seheili*.

South of the West-Hill Marine Biological Station is a stream which is connected with the sea during high tide but is cut off from it by a sand bar during low tide. It is noticed that during low tide *Mugil seheili* are trapped in the stream. The fishes were collected from this locality and kept in a glass tank filled with salt-water. The water in the tank was kept constantly aerated by means of a simple aeration apparatus. Gradually the salinity of the water in the tank was reduced by the admixture of fresh well water for a period of 12 days when the tank was filled entirely with fresh-water. The fishes were fed on fresh plankton—Copepod, Leucifer, Sagitta, etc. It was observed that the fishes were not in the least affected by the changes in salinity. They continued to thrive very well in fresh-water. There is every reason to believe that the freshwater fishery resources can be made more productive by stocking them with *Mugil seheili*.

Marine Biological Station,
West-Hill,
December 10, 1943. R. S. VENKATARAMAN.

† Published with the kind permission of the Director of Industry and Commerce, Madras.

* Devanesen D. W., and Chacko P. I., *Proc. Nat. Inst. Sci.*, 1943 **19**, No. 2.

REVIEWS

Physics and Philosophy. By Sir James Jeans. (Cambridge University Press), 1942. Pp. vii + 222. Price 8/6.

The human mind has generally attempted to interpret observations in terms of simple and fundamental concepts. The growth of experimental enquiry that has been the root of scientific progress has proceeded side by side with speculation in the formulation of theories. Such theories have in general attempted pictorial representations of the phenomena that have unfolded themselves to the experimenter. Recent progress in physics has seriously interfered with the facility with which such representation had been attempted in the past. Space-time and the wavicle have as yet refused to be pictured except by doubtful analogies. The law of causality, long inherent in the human mind, has been attacked. Finally, whereas the experimentalist goes on merrily with what he regards as a concrete and objective world, the philosophical scientist has revived the great question as to what exactly lies beyond the observers' mind and his senses. What do we mean by reality and how do we arrive at a concept of it?

Sir James Jeans is one of those who have been seeking to explore the philosophical implications of the latest theories in physics, and the book under review is one of the many that have recently been written on the subject. A study of some of these books, such as have been written by Eddington, Jeans and Dingle, shows that the authors hardly see eye to eye on many important matters, which result can only be explained by the nature of the subject.

The book starts with a disquisition on the nature of physical knowledge and proceeds with a short review of the progress of philosophical thought during the ancient, medieval, the renaissance and later periods. This is followed by a discussion on 'sources of knowledge' or the ways of acquiring a knowledge of the external world, including a critical review of the views of writers such as Plato, Thales, Decartes, Spinoza, Leibniz, Kant and others leading up to the modern philosophers. The growth of mathematical and physical concepts, particularly those relating to space and time is then described. Chapter three opens with a consideration of the precision of the language and terminology employed in philosophy and in science respectively and the relative exactness of the connotations of the terms employed in them. The author explains how doubts and disputes would arise from uncertain connotations and considers the different meanings that a statement may convey to a physicist and a philosopher.

This is followed by a study of the progress of mechanistic views of the world and its phenomena as developed by the earlier great physicists, and the shock these views received through the work of Planck, Einstein, Heisenberg, Dirac and others. These later contributions are then explained and their reaction on the classical ideas discussed in two chapters. The last chapter constitutes a philosophical enquiry into the problems considered so far.

There is first a search for a philosophic approach to the puzzling experiences of the physicist, expressible by fairly satisfactory mathematical symbolism, but eluding attempts at forming consistent pictures or models to describe the phenomenal world, as in the case of the particle-wave character of matter and radiation and the four-dimensional space-time. The author then proceeds to say 'we have seen that efforts to discover the true nature of reality are necessarily doomed to failure' and suggests that progress lies in what he terms 'probable reasoning' and the 'simplicity postulate' which he then elaborates. There is then a short discussion on reality and appearance and on mind and matter. The book closes with an analysis of the arguments for determinism and indeterminism (free-will), leading up to his conclusion that 'modern philosophy also seems to have come to the conclusion that there is no real alternative to determinism'.

A. VENKAT RAO TELANG.

Physics and Radio. By M. Nelkon. (Edward Arnold & Co., London), 1944. Pp. 388 + vi. Price 8/6.

This book is an attempt to present the fundamental physical principles of Radio to those who desire to become radio technicians and to the average science student qualified to enter a collegiate institution in India or elsewhere. It is divided into twenty-five chapters dealing with the electrical structure of matter, D.C. theory, electrolysis, electrostatics, magnetism, electromagnetism, A.C. circuit theory, and the valve as an oscillator, voltage amplifier, power amplifier, etc. There is a chapter on sound which contains an elementary discussion on aerials and a chapter on light giving some description of the ionosphere. The cathode-ray oscilloscope comes up for detailed treatment suitable for the readers to whom it is addressed in a separate chapter. There are suitable numerical examples and questions at the end of each chapter. The printing, get-up, illustrations, etc., are good. The treatment of the subject-matter is quite good in every chapter and the arrangement of the matter is quite logical and systematic. A knowledge of mathematics of the matriculation standard is adequate for following the subject-matter of the book.

In the opinion of the reviewer, it is a book biased towards physics. There is not the necessary emphasis on the technical and practical side of Radio. This is not very desirable in a book which goes into the hands of a technician. The necessary theory has always to be linked with the day-to-day problems he has to handle. Consequently, the book cannot be regarded as a very useful one for Radio Mechanics and Wireless Operators. Such persons may find it very useful for supplementary reading.

Unfortunately, in our country, the physics of radio comes for very little attention in our schools and colleges. Some chapters of the book serve the most useful purpose of filling this gap and are to be very strongly recom-

mended to pass B.Sc. students doing physics as one of their subjects and to B.Sc. students doing physics as a subsidiary subject. Part of the book is also certainly useful to electrical engineering diploma students who are required to know some of the basic principles of Radio.

S. V. CHANDRA-SHEKHAR AIYA.

The Indian Central Cotton Committee Report, 1943

The twenty-second Annual Report of the Indian Central Cotton Committee for the year ending 31st August 1943, records another year of its useful work for the benefit of the grower and the consumer of raw cotton. The most outstanding event in the year was its declaration of policy which should be followed during the period of war. It stressed the need for a balanced production of the various types of cotton grown in the country. The annual exports to Japan on an average used to be 1.5 million bales, consisting mostly of the short-staple varieties and the whole of this was a surplus without a market. The Committee requested the Government of India to urge on all the Provinces and States growing short- and fair-staple cotton to reduce forthwith the acreage by at least 50 per cent.; and to grow food-crops instead as adequate stocks or reserves of the produce of the latter will be a vital national asset for some years to come. This was followed by the Government of India creating a special "cotton fund" from the proceeds of the levy of an additional duty of one anna per pound on all imported cotton to finance measures for assisting the grower of certain types of cotton which used to be exported in large quantities to the Far East. At the instance of the Committee, the specifications of the goods required by the Government were relaxed so as to enable more Indian cotton, particularly short-staple, to be used in the manufacture of such articles. The "Grow More Food" campaign on a country-wide basis was started, in which the cultivators were advised to grow more food-crops in the place of the short-staple cotton. The Government of Bombay stopped facilities

for the movement of unwanted short-staple cotton to Bombay. The Broach, Oomras and the Bengals contracts were replaced by a new "Indian Cotton Contract" with fine Jarilla $\frac{3}{4}$ -inch staple as the basis. All these effected in the reduction of the Indian short-staple cotton acreage by 43 per cent. Besides the above short-range or emergency plan, the Committee had a long-range policy as well. India at present consumes annually over six lakhs bales of foreign cotton, mostly of staple above one inch while the production in the country of similar cotton up to one-inch staple length amounts at present to 161,000 bales. The Report shows that the aim of the Committee has been one of financing schemes of research which would produce suitable long-staple varieties to meet the requirement of the Indian mill industry, the best customer of the Indian cotton. Further the Committee did not lose sight of the interest of the grower for it passed a resolution in its July 1943 meeting that the Government should fix equitable minimum prices for the different descriptions of cotton in consultation with the Committee and that the Government should be prepared to buy any cotton whenever offered to it at the minimum prices. Despite war conditions, with comparatively leaner funds, the activity of the Committee continued as of old and good progress was recorded in each branch. The area of improved cotton from 24 per cent. of the total cotton acreage in 1938-39 rose to 54 per cent. of the total in 1942-43. The improvement in the staple of the Indian crop has been noteworthy as the proportion of cotton of $\frac{3}{4}$ -inch staple and above to the total increased from 30 per cent. of 1922-27 to 38 per cent. in 1937-42, to 45 per cent. in 1941-42, and to 60 per cent. in 1942-43. The production of medium- and long-staple cotton in 1942-43 increased by 75 per cent. as compared with that of 1922-27. The Committee has been taking steps to increase the production of cotton of staple length over one inch of which over six lakhs bales are imported annually from abroad. The production of this class of cotton which was nil in 1922-27 amounted to 594,000 bales in 1942-43.

SCIENCE NOTES AND NEWS

Addressing the Institute of Engineers on 'Some scientific factors in post-war Industrial Development', Sir Shanti Swarup Bhatnagar said: "In advanced countries all scientific research is now generally administered by one Government Department. In this country, even so closely related subjects as Agricultural Research and Industrial Research are under separate departments. It is obvious that any large-scale programme of industrial development should, at the same time, envisage a correspondingly large-scale agricultural development of the country. It is fortunate that on the question of India's agricultural development there is no difference of opinion amongst

the politicians, the scientists and the industrialists of the country or those of Great Britain. It is only with respect to industrial development that there seems to be a difference of opinion to the extent and the development which should form our targets. Politics, not science, has been responsible for this lack of decision. The advantages which a co-operative programme of development presents have also been clouded by political considerations.

Sir Shanti Swarup gave a comprehensive survey of the scientific services that would be required, the work of Government Departments in publishing scientific material, of research associations, commodity laboratories

which had sprung up in Europe and America largely as a result of the industry agreeing to a levying of cess for research purposes, and patent laws. The speaker said that it was painful to notice that in spite of the training given in our universities and technical institutes there was a great paucity of suitable technical talent in this country. He thought there would be need of foreign talent and although national talent should be developed as soon as possible, in the initial stages we should have to import foreign experts for many industries.

It is understood that the Council of Scientific and Industrial Research has under consideration the question of building a Road Research Station and Laboratory.

A scheme costing about Rs. 4 lakhs for the reorganisation of pharmaceutical education in the Province, has it is learnt, been drawn up by the Sub-Committee appointed by the Post-War Reconstruction Committee of the Government of Bengal. The Committee consider that there should be at least two colleges of pharmacy in Bengal for higher training of pharmaceutical graduates, and several subsidiary centres in various Government and non-Government medical schools for the training of licentiates in pharmacy.

A comprehensive scheme for the improvement and development of tobacco in India has been sanctioned by the Governing Body of the Imperial Council of Agricultural Research at a cost of Rs. 16 lakhs. The direction of this work will be taken over by the Indian Central Tobacco Committee which is likely to be set up next winter. This Committee will be responsible for research, development and marketing of all kinds of tobacco grown in India and for its finances the Government is already allotting Rs. 10 lakhs annually from the Tobacco Excise Fund.

For the expansion of the Department of Chemical Technology, University of Bombay, Sir Vithal Chandavarkar, Chairman of the Mill-owners' Association, has donated a sum of Rs. 400,731. About a lakh and a half of the amount is to be utilised for the erection of a pilot plant laboratory for dyestuff technology; half a lakh is set apart for a laboratory for advanced research in textile chemistry and another half a lakh for special equipment in connection with studies on modern methods of finishing textiles. A lakh and a quarter will be reserved for the institution and maintenance of two research assistantships in textile chemistry.

The proposal made by the Syndicate of the Andhra University at its meeting held on 10th June 1944 to confer on His Excellency Captain the Honourable Sir Arthur Oswald James Hope, G.C.I.E., M.C., Governor of Madras and Chancellor of the University, the Honorary Degree of D.Litt., has been agreed to by His Excellency the Chancellor of the Andhra University. The Degree will be conferred at

the next Convocation which will be held on Saturday, 18th November 1944.

On the recommendation of the Committee of Award supported by the Syndicate of the Andhra University, H. E. the Chancellor has been pleased to offer the Sir C. R. Reddi National Prize to Sir C. V. Raman, who has accepted it. Sir C. V. Raman will receive the Prize in person at the forthcoming Convocation of the Andhra University to be held on 18th November 1944.

Pursuit to a resolution passed at the recent meeting of the Central Committee of the All-India Manufacturers' Organisation, Bombay, advocating protective Government measures for essential industries particularly those started during war, the Working Committee invites interested industrialists to get immediately in touch with the Secretary at its address: Industrial Assurance Building, Opp. Churchgate Station, Bombay, to enable the Organisation to urge where necessary, the adoption by Government of one or more of the following among other safeguarding methods:—(a) Protective tariffs, (b) bounties and or subsidies, (c) guarantee of interest on invested capital, (d) facilities for importation of essential raw and semi-manufactured materials, (e) provision by means of priorities of suitable equipment and technical assistance.

It is hoped that the parties interested will assist the Organisation in its work by immediately forwarding complete statements including (1) the date of the establishment of the factory, (2) the amount of capital invested, (3) the output and the value of products, (4) the nature of the difficulties experienced in detail, (5) the nature of protection desired in detail.

The information supplied will be kept confidential.

Informations are particularly sought for among others the following types of industries:—(1) Industries started or developed with further capital investments at the instance of the Government, (2) industries which are in the nature of key or defence industries, (3) industries which can be developed into or as adjuncts of heavy industries, (4) industries in respect of which it is essential for the country to be independent of foreign supplies in times of war, (5) industries providing articles serving as ancillaries for other industries, (6) industries utilizing waste products of other industries, (7) industries catering to educational and cultural developments of the country, (8) industries manufacturing such consumers' goods as are required to raise or maintain at least the minimum standard of life of the people.

Prof. B. V. Bhidé, one of the members of the Governing Body of The Indian Drugs Research Association, Poona, has sent us the following appeal:

"Indian Drugs" is a very vast and an equally important field for research, both from the scientific and national points of view.

The research in the field of drugs necessitates an adequate knowledge of various physi-

cal and natural sciences, like chemistry, botany, pharmacology, medicine and others. With the advance of modern sciences and the analytical method of study, it is impossible for one individual to be a master of all and a teamwork with proper co-ordination is extremely essential to make any real progress in the field. The realisation of these facts has already created many co-ordinated research organisations in other countries advanced in physical sciences, and the same is responsible to bring the Indian Drugs Research Association into existence.

We have fortunately been successful in enlisting an active support of various experts in their own fields and we have already secured the co-ordination of some of the existing laboratories, before reaching a stage when the Association can have its own equipment and staff. But even to utilise the existing institutions for this purpose, the cost of the new investigation work shall have to be incurred by the Association. The amount of the memberships and subscriptions can never cope with the cost of such a work. As such, we request the rich and interested to extend a financial support to the work of the Association. This is not a commercial body manufacturing any patent drugs. The aim of the body is purely scientific and pure work many a time leads to some applications in the immense spheres of industries, and we hope that the industrialist will realise the necessity to maintain such pure work out of their own profits.

The duty of the Association is to collect a new knowledge, which will be a property of our nation and humanity and we appeal to all individuals and institutions interested in the welfare of the nation to extend their help and co-operation for the advancement of knowledge which will be our real heritage to the posterity. You can help the Association—

- (1) by enrolling yourself as a member, patron or a donor;
- (2) by requesting your friends to enrol themselves in any of the suitable categories;
- (3) by suggesting new lines of work in our field;
- (4) by communicating the results of your own work and observations to the Association; and
- (5) by rendering any other kind of help which will benefit the Association in furtherance of its aims and objects.

All communications and enquiries may be addressed to Dr. G. S. Pendse, Hon. General Secretary, The I.D.R.A., 631/27, Sadashiv Peth, Poona 2.

Watumull Foundation is offering (1) a travelling Fellowship for one year, and (2) ten scholarships to Indian men and women to carry on higher studies and research in American universities and institutions for advanced agricultural and technical education for two years. The travelling Fellow must be (a) a Professor in an Indian University or College; or (b) a recognised scientist with the highest type of professional attainments. He must indicate in his application the nature of the research work, investigation or special study he desires to pursue during the stay in

the United States. The applicant finally selected will receive a stipend covering travelling expenses to the United States and return to India, plus an allowance of approximately Rs. 825 a month during the year. The ten scholars selected must have graduated First or Second Class M.A. or M.Sc., from an Indian University with research experience, or be graduate medical students with a M.B. degree from an Indian university with research experience; or be graduate engineers with a B.E. or B.Sc. degree in engineering; or graduates of agricultural colleges. Further particulars may be had from The United States Office of War Information, Dept. W., 293, Hornby Road, Bombay.

SEISMOLOGICAL NOTES

Among the earthquake shocks recorded by the seismographs in the Colaba Observatory during the month of August 1944, there were seven of slight intensity. The details for those shocks are given in the following table:

Date	Intensity of shock	Time of origin (I.S.T.)	Epicentral distance from Bombay	Co-ordinates of epicentre	Depth of focus
		H. M. (Miles)			(Miles)
3	Slight	05 25	1470		
7	Slight	09 56	10150		
8	Slight	15 03	4770		
14	Slight	20 52	3190		
15	Slight	18 18	4510		
18	Slight	17 04	3900		80
31	Slight	07 04	1510		

MAGNETIC NOTES

Magnetic conditions during August 1944 were more disturbed than in the previous month. There were 19 quiet days, 11 days of slight disturbance and 1 day of moderate disturbance, as against 5 quiet days, 20 days of slight disturbance and 6 days of moderate disturbance during the same month last year.

The quietest day during the month was the 20th and the day of the largest disturbance the 18th.

The individual days during the month were classified as shown below:

Quiet days	Disturbed days	
	Slight	Moderate
4-7, 9, 11-17, 19-22, 25, 26, 27	1-3, 8, 10, 23, 24, 27-29, 31	18

A disturbance of moderate intensity occurred during the month of August 1944 while one of moderate intensity occurred during August 1943.

The mean character figure for the month of August 1944 was 0.42 as against 1.03 for August 1943.

M. PANDURANGA RAO.

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Views of Scientists regarding 'SACWO' Products

I was privileged to see the workshops of The Scientific Apparatus and Chemical Works, Ltd., Agra, and I was delighted to find out that numerous Articles are being manufactured. The apparatus seems to be prepared to meet the requirements even of specialists and it is my firm belief that such enterprising workshops should be called upon to manufacture new Instruments and research requirements of all the Scientific Institutions in this country. The Sacwo's men and management appear to be very enthusiastic. I wish the Company a bright future in the scheme of National Scientific Development.

G. R. PARANJPE
(MSc., F.N.I., I.E.S., J.P.)
Principal, Royal Institute of Science
Bombay
3rd May 1939

